



DEPARTMENT OF THE AIR FORCE
59TH MEDICAL WING (AETC)
JOINT BASE SAN ANTONIO - LACKLAND TEXAS

15 APR 2016

MEMORANDUM FOR SGST

ATTN: LT COL JACQUELINE KILLIAN

FROM: 59 MDW/SGVU

SUBJECT: Professional Presentation Approval

1. Your paper, entitled **The Impact of a Novel Biobehavioral Intervention on Physiologic State, Perceived Stress and Affect** presented at **Uniformed Services University Research Day May 25 2016** with MDWI 41-108, and has been assigned local file #**16160**.
2. Pertinent biographic information (name of author(s), title, etc.) has been entered into our computer file. Please advise us (by phone or mail) that your presentation was given. At that time, we will need the date (month, day and year) along with the location of your presentation. It is important to update this information so that we can provide quality support for you, your department, and the Medical Center commander. This information is used to document the scholarly activities of our professional staff and students, which is an essential component of Wilford Hall Ambulatory Surgical Center (WHASC) internship and residency programs.
3. Please know that if you are a Graduate Health Sciences Education student and your department has told you they cannot fund your publication, the 59th Clinical Research Division may pay for your basic journal publishing charges (to include costs for tables and black and white photos). We cannot pay for reprints. If you are 59 MDW staff member, we can forward your request for funds to the designated wing POC.
4. Congratulations, and thank you for your efforts and time. Your contributions are vital to the medical mission. We look forward to assisting you in your future publication/presentation efforts.

Linda Steel-Goodwin

LINDA STEEL-GOODWIN, Col, USAF, BSC
Director, Clinical Investigations & Research Support

| PROCESSING OF PROFESSIONAL MEDICAL RESEARCH/TECHNICAL PUBLICATIONS/PRESENTATIONS | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| 1. TO: CLINICAL RESEARCH | 2. FROM: (Author's Name, Rank, Grade, Office Symbol) Jacqueline Killian, Lt Col, O5, 59MDW/ST | 3. GME/GHSE STUDENT: <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO | 4. PROTOCOL NUMBER: USU-TO-61-3105 |
| 5. PROTOCOL TITLE: (NOTE: For each new release of medical research or technical information as a publication/presentation, a new 59 MDW Form 3039 must be submitted for review and approval.) A Biobehavioral Intervention's Impact on Physiologic State, Perceived Stress and Affect | | | |
| 6. TITLE OF MATERIAL TO BE PUBLISHED OR PRESENTED: The Impact of a Novel Biobehavioral Intervention on Physiologic State, Perceived Stress and Affect | | | |
| 7. FUNDING RECEIVED FOR THIS STUDY? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO FUNDING SOURCE: Jonas Scholars Grant & USUHS | | | |
| 8. DO YOU NEED FUNDING SUPPORT FOR PUBLICATION PURPOSES: <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO | | | |
| 9. IS THIS MATERIAL CLASSIFIED? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO | | | |
| 10. IS THIS MATERIAL SUBJECT TO ANY LEGAL RESTRICTIONS FOR PUBLICATION OR PRESENTATION THROUGH A COLLABORATIVE RESEARCH AND DEVELOPMENT AGREEMENT (CRADA), MATERIAL TRANSFER AGREEMENT (MTA), INTELLECTUAL PROPERTY RIGHTS AGREEMENT ETC.? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO NOTE: If the answer is YES then attach a copy of the Agreement to the Publications/Presentations Request Form. | | | |
| 11. MATERIAL IS FOR: <input checked="" type="checkbox"/> DOMESTIC RELEASE <input type="checkbox"/> FOREIGN RELEASE CHECK APPROPRIATE BOX OR BOXES FOR APPROVAL WITH THIS REQUEST. ATTACH COPY OF MATERIAL TO BE PUBLISHED/PRESENTED. | | | |
| <input type="checkbox"/> 11a. PUBLICATION/JOURNAL (List intended publication/journal.) | | | |
| <input type="checkbox"/> 11b. PUBLISHED ABSTRACT (List intended journal.) | | | |
| <input checked="" type="checkbox"/> 11c. POSTER (To be demonstrated at meeting: name of meeting, city, state, and date of meeting.) Uniformed Services University Research Day May 25, 2016 | | | |
| <input type="checkbox"/> 11d. PLATFORM PRESENTATION (At civilian institutions: name of meeting, state, and date of meeting.) | | | |
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| 15. AUTHORSHIP AND CO-AUTHOR(S) List in the order they will appear in the manuscript. | | | |
| LAST NAME, FIRST NAME AND M.I. | | GRADE/RANK | SQUADRON/GROUP/OFFICE SYMBOL |
| a. Primary/Corresponding Author Jacqueline Killian | | O-5/Lt Col | 59 MDW/ST |
| b. | | | |
| c. | | | |
| d. | | | |
| e. | | | |
| f. | | | |
| I CERTIFY ANY HUMAN OR ANIMAL RESEARCH RELATED STUDIES WERE APPROVED AND PERFORMED IN STRICT ACCORDANCE WITH 32 CFR 219, AFMAN 40-401_IP, AND 59 MDWI 41-108. I HAVE READ THE FINAL VERSION OF THE ATTACHED MATERIAL AND CERTIFY THAT IT IS AN ACCURATE MANUSCRIPT FOR PUBLICATION AND/OR PRESENTATION. | | | |
| 16. AUTHOR'S PRINTED NAME, RANK, GRADE Jacqueline Killian Lt Col/ O5 | | 17. AUTHOR'S SIGNATURE KILLIAN, JACQUELINE M. 1050091 976 <small>Digitally signed by KILLIAN, JACQUELINE M. 1050091 DN: cn=JACQUELINE M. 1050091, ou=59MDW, ou=USAF, email=jkillian@59mdw.af.mil, c=US Date: 2016.04.06 11:07:03 -0500</small> | |
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| 1st ENDORSEMENT (59 MDW/SGVU Use Only) | | |
| TO: Clinical Research Division 59 MDW/CRD Contact 292-7141 for email instructions. | 22. DATE RECEIVED 4/7/2016 | 23. ASSIGNED PROCESSING REQUEST FILE NUMBER 16160 |
| 24. DATE REVIEWED 7 Apr 2016 | | 25. DATE FORWARDED TO 502 ISG/JAC |
| 26. AUTHOR CONTACTED FOR RECOMMENDED OR NECESSARY CHANGES: <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES If yes, give date. _____ <input type="checkbox"/> N/A | | |
| 27. COMMENTS <input checked="" type="checkbox"/> APPROVED <input type="checkbox"/> DISAPPROVED The poster is approved. | | |
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| 40. PRINTED NAME, RANK/GRADE, TITLE OF REVIEWER Michael Ellis, SSgt, 59 MDW PA | 41. REVIEWER SIGNATURE ELLIS.MICHAEL.ALLEN.10465568 40 <small>Digitally signed by ELLIS.MICHAEL.ALLEN.10465568 DN: cn=Michael Allen, o=59 MDW, ou=USAF, email=michael.allen@usaf.mil, c=US Date: 2016.04.15 14:27:05 -0500</small> | |
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The Impact of a Novel Biobehavioral Intervention on Physiologic State, Perceived Stress and Affect

Lt Col Jacqueline Killian, 59 MDW/ST, JBSA-Lackland

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TIRP

Traumatic Injury Research Program

MILITARY SIGNIFICANCE

As a result of over 15 years of war, members of the military services have experienced unprecedented consequences related to the stresses of serving during this time.¹⁻³ Early detection, characterization, and treatment of stress-related disorders is one of the highest priorities for the armed forces and military medical research, as a means of force health protection. One complementary intervention, laughter yoga (LY), has yet to be investigated in a military population but is a promising treatment for stress related disorders.^{1,2}

BACKGROUND

- Significant health problems associated with chronic stress include: heart disease, cancer, asthma, and gastrointestinal disturbances.³
- Physiologic response to stress involves a cascade of complex internal multisystem actions.
- Cardiovascular and respiratory systems are complementary and reciprocal, providing continual modulation to maintain allostasis.
- Individuals resilient to stress have been shown to return to allostasis more quickly; activating their sympathetic nervous system (SNS) to respond more efficiently while mitigating the damaging effects of allostasis load.⁴
- Heart rate variability (HRV) is a means of measuring autonomic nervous system response.⁵
- variability = SNS activation potentially caused by acute or chronic stress
- variability = vagal tone/ parasympathetic nervous system activation (PNS).⁶
- Respiratory system response to stress = respiratory rate and tidal volume
- Slower respiratory rate with larger tidal volumes stimulate the vagus nerve, which activates the PNS
- LY involves physical exercise and breath work that stimulates the vagus impacting sympathetic parasympathetic balance and increases oxygen which is known to aid in healing and improving energy levels to aid in stress management.

PURPOSE

The search for innovative, non-invasive and cost-effective means of mitigating the effects of stress is the basis of this pilot study.
Purpose: To explore the use of LY as a method to mitigate the physiologic effects of stress and begin to identify the protective factors associated with resilience in a military student population.

METHODS

Design: Quasi-experimental pre/post-test wait-listed control group

| | T 1 | Wk 1 | Wk 2 | Mid-Study | Wk 3 | Wk 4 | T 3 |
|------------------------------------------|-----|------|------|-----------|------|------|-----|
| Experimental (E) Group (n = 20) | X | LY | LY | X | — | — | X |
| Wait-listed Control (WLC) Group (n = 21) | X | — | — | X | LY | LY | X |

Table 1. Experimental Design. X denotes observation / measurement collection

Disclaimer: The opinions expressed herein are those of the authors, and are not necessarily representative of those of the Uniformed Services University of the Health Sciences (USUHS), the Department of Defense (DOD), or the United States Army, Navy, or Air Force.

METHODS

Sample: 41 volunteer military graduate students age 23-52 (M = 31) randomly assigned to E and WLC groups

Physiologic data acquisition devices:

- emWave2 device (HeartMath LLC)⁹ uses photoplethysmography to obtain pulse waveform from the microvascular tissue bed via sensor attached to ear lobe with an ear clip (Fig. 1)



Figure 1. emWave2 device

- Handheld Peak Flow Meter (Mabisdmi.com)⁹ measures the amount of air expelled from the lungs following deep inhalation (Fig. 2)



Figure 2. Mabisdmi Handheld Peak Flow Meter

Physiologic Measures:

- Heart Rate Variability & Peak Expiratory Flow Rate
- 10 minutes cardiac inter-beat interval (IBI) data
- 3 Peak Flows were collected:
 - at baseline and following the 2 week intervention period
 - before and after each LY session

Heart Rate Variability

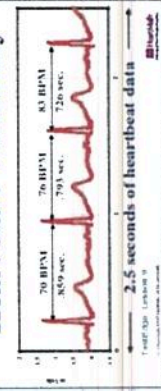


Figure 3. Illustration of heart rate variability defined as the difference in milliseconds between heart

Self Report Measures:

- Perceived Stress Scale
- PHQ-8 (measure of depressive symptoms)
- PANAS (Positive Affect Negative Affect Scale)
- CD-RISC (Connor Davidson Resilience Scale)
- General Health Scale (SF-36)
- Open-ended questions regarding the laughter yoga experience

DATA ANALYSIS

- Independent sample and paired t tests were performed for between groups and within group comparison for physiologic measures along with Friedman's two-way analysis of variance by ranks with pairwise comparison with Bonferroni correction for multiple comparisons over six time points.
- Man-Whitney U were performed for between group comparison and Wilcoxon Signed Rank for within groups comparison of change scores calculated from self-report scores
- Independent thematic analysis of verbal responses to open ended questions (accomplished by five research team members)

RESULTS

- Independent samples t test results indicate no significant difference at baseline nor post intervention for between groups comparison.
- Results of paired sample t test are reported in Table 2.
- Repeated measures analysis of variance conducted to determine if any significant differences occurred over six time points. Results of Friedman test indicated that measures of STD HR and PEFR were significantly different as follows:
 - STD HR ($\chi^2 (5, n = 32) = 14.05, p = .015$). Inspection of median values showed decrease from baseline ($Md = 4.99$) to T2 ($Md = 4.15$) which appeared to recover by post-intervention ($Md = 4.89$)
 - PEFR ($\chi^2 (5, n = 41) = 184.26, p < .001$). Inspection of median values showed decrease from baseline ($Md = 463.33$) to T2 ($Md = 317.16$) which increased by post-intervention ($Md = 480$)

RESULTS

| Results of Paired Sample t Test Comparing Pre and Post Intervention Physiologic Measures of Heart Rate Variability (HRV) and Peak Expiratory Flow Rate (PEFR) for Experimental (Ex) and Wait-listed Control (WLC) Groups | | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------|----|---------|--|--|
| Variable | Group | T Statistic | Df | p value | | |
| STD RR | Ex | 3.111 | 19 | .006* | | |
| | WLC | 1.012 | 17 | .327 | | |
| RMSSD | Ex | 2.494 | 19 | .023* | | |
| | WLC | 1.998 | 17 | .063 | | |
| HF | Ex | 2.378 | 19 | .029* | | |
| | WLC | 1.32 | 17 | .206 | | |
| PEFR | Ex | -4.442 | 20 | <.001* | | |
| | WLC | -1.046 | 21 | .308 | | |

Table 2. Statistically significant decreases for STD RR (Standard deviation of the R to R interval), RMSSD (Root mean square of successive differences between inter-beat intervals) and HF (High Frequency) HRV measures and statistically significant increase in PEFR. Note: * indicates statistical significance, set at $p < .05$.

| Variable | GP | N | Md | Mann Whitney U | Test Statistic | Effect Size (r) |
|--------------------------|-----|----|-------|----------------|----------------|-----------------|
| Positive Affect | Ex | 20 | 125.5 | 147.5 | -1.633 | .26 |
| | WLC | 21 | 2 | | | |
| SF36 Role Emotional | Ex | 20 | 8.33 | 147.5 | -1.633 | .26 |
| | WLC | 21 | -8.34 | | | |
| SF 36 Mental Health | Ex | 20 | 5 | 320.5 | 2.91 | .45 |
| | WLC | 21 | 0 | | | |
| SF 36 Physical Component | Ex | 20 | -2.7 | 100 | -2.695 | .42 |
| | WLC | 21 | 2.14 | | | |

Summary Table 3. Results of between groups comparison Mann Whitney U analyses. Note: N= number of participants in each group; U = Mann-Whitney U statistic; P = p value; r = measure of effect size, using Cohen (1988) criteria of 1 = small effect, 3 = medium effect and 5 = large effect.

| Variable | N | Test Statistic | P (<.05) | Observed Median | Effect Size (r) | % Score Change (Improvement) |
|---------------------|----|----------------|----------|-----------------|-----------------|------------------------------|
| PSS | 41 | .091 | .928 | 0 | .01 | 45% |
| PA | 41 | 4.369 | <.005* | 11 | .48 | 29% |
| NA | 41 | -1.789 | .074 | -1 | .01 | 76% |
| PHQ8 | 41 | -1.154 | .248 | 0 | .18 | 46% |
| SF36 Role Physical | 41 | 1.994 | .046* | 0 | .22 | 17% |
| SF 36 Gen Health | 41 | 2.137 | .033* | 5 | .24 | 16% |
| SF 36 Mental Health | 41 | 5.484 | <.005* | 12.9 | .61 | 2% |
| Resilience | 41 | 2.158 | .031* | 2 | .24 | 27% |

Table 4. Results of Wilcoxon Signed Rank analyses. N = number of participants in each group; z = z score; * indicates significant finding; P < .05; r = measure of effect size, using Cohen (1988) criteria of 1 = small effect, 3 = medium effect and 5 = large effect.

- Thematic analysis of verbal responses to open ended questions resulted in four main themes regarding how laughter yoga participation affected their mood, sensory state, relationships and lifestyle choices.

IMPLICATIONS

Results of this pilot study contribute to the growing body of evidence regarding the physiologic and psychological impact of LY participation. Changes observed in HRV measures and PEFR suggest that participation in LY may provide an alternative aerobic activity that can assist in reducing stress while improving respiratory status. Whereas increases in positive affect, mental health and resilience scores, as well as participant open responses indicate further investigation is needed to determine whether continued participation would result in progressive changes that could promote resilience in military members.

*Acknowledgments: This research was funded by the Joint Center for Nursing and Veterans Healthcare and the Uniformed Services University of the Health Sciences (USUHS). Support and resources were also provided by the Traumatic Injury Research Program (TIRP), Military & Emergency Medicine Department of USUHS. Dr. Penny Perine, Dr. Catherine Ling, Dr. Paul Rapp, Dr. David Kessler, Dr. Dominic Nathan and Dr. Cara Olsen are acknowledged for their guidance, patience, support and encouragement throughout the research process.

Figure 3. Illustration of heart rate variability defined as the difference in milliseconds between heart

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- Increased variability denotes increased vagal tone and activation of the parasympathetic nervous system.⁶
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- LY involves physical exercise and breath work that stimulates the vagus impacting sympathetic parasympathetic balance and increases oxygen which is known to aid in healing and improving energy levels to aid in stress management
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